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NEWSLETTER OF THE LONDON CHAPTER,
ONTARIO ARCHAEOLOGICAL SOCIETY



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87-7

**Archaeological Excavations of the San Juan,
a Spanish Basque Whaling Ship at Red Bay, Newfoundland**

While many will know her as a land-based consultant archaeologist presently working for the Regional Municipality of Waterloo, **Scarlett Janusas** also has a burning passion for underwater archaeology. Scarlett will report on her 1985 experiences as a member of the archaeological team working at Red Bay Newfoundland, one of the most important early historic sites in North America. Meeting time is, yet again, at 8 PM in the beautiful confines of the Museum of Indian Archaeology.

**Chapter
Executive**

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EXECUTIVE REPORT

Things are still in transition around the Chapter Office, between the hectic field season of summer and the hectic indoor season of winter. Our Van Bemmell site excavations are still going, and will continue until mid or late November (depending on frost and snow cover). Many volunteers have come out to the site so far, but there is still plenty of work left for those who have not. A reminder to members too, the Van Bemmell excavations is a **Passport to the Past** opportunity. The Chapter president has been designated official "stamper", so please see Neal if you want a stamp for your Van Bemmell volunteer work, or other volunteer work done for the Chapter.

Local Initiatives Committee Chairman Mike Gibbs reported at the Thursday October 1 Executive meeting of his activities as Chapter representative to LACAC. Mike, along with Bob Pearce (who sits on LACAC as a member at large), have made several presentations to LACAC regarding local archaeological heritage over the past 9 months, and are now serving on an archaeological sub-committee, along with two other LACAC members, in order to explore ways of promoting archaeological conservation to the City. Mike reports that this sub-committee will present a brief to LACAC, recommending that the group puts forth a motion to the City's Planning Department that the City consider having a Master Plan study done for London. Progress...slow, but sure!

Mike also recommended that the Chapter consider putting together an audio-visual presentation on local archaeology, the OAS and the London Chapter, to be shown during Heritage Week next February. Apparently many of the City's heritage organizations will have displays at the London Art Gallery that week, and Mike feels an audio-visual display would be the best way to promote archaeology and the society. The display can also be used later for promotion at other events. Mike has agreed to look at the costs of renting a slide projecting box, etc., and will report back next month.

A reminder to members that the Executive is still looking for individuals willing to help with the production of KEWA, but we are also looking for a member who would like to assist the Chapter by sitting on the Executive in a directorship capacity. This position is intended to assign one person a specific task or project for the Chapter during a year, as well as introduce the member to the workings of the executive, in the hopes that this individual might fill an executive position in subsequent years. In order for the Chapter to survive we need to ensure a steady stream of "fresh faces" and continuity on the executive (after all George may want to retire as treasurer sometime during the next couple of decades!). While on that note, a formal call for nominations for all executive positions will appear in next month's issue.

SOCIAL REPORT

We would ideally like to advertise the time and place of our annual Christmas party in next month's issue of KEWA, however that is entirely contingent on someone offering a place for this event to take place. If you have a fair-sized home and would like to host 10-20 polite and pleasant Chapter members, please contact someone on the executive as soon as possible. To all members please note: our annual Christmas Party is also our annual member's business meeting and executive election. Issues concerning the future of the Chapter are discussed and voted on then, so please make a point of turning up for the meeting, if the food and company isn't enough to lure you out!

Lab nights have begun once again! A combination of both old and new faces greeted members as they arrived for the first lab night on Thursday, October 15, and as

always coffee and conversation poured out fast and furious. If you are looking for a very relaxed and informal get together to discuss a host of topics, learn a little archaeology, and hear tall tales - all this while working over some 7000 years of Ontario Prehistory - our lab nights are for you. Lab nights begin at 7 pm at 55 Centre Street, and remember, lab nights are also a stampable activity for "Passporters".

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The following is a full copy of the London Chapter's submission to the Ontario Heritage Act Review Committee, written over the summer and submitted for the Committee's July 31 deadline:

**Comments on the Heritage Act
from the London Chapter of The Ontario Archaeological Society Inc.**

To Greg Baeker and Heritage Act Review Committee Members:

We of the London Chapter of the Ontario Archaeological Society Inc. would like to express our appreciation in having the opportunity of submitting this brief to you, outlining some observations, comments and concerns regarding the Heritage Act as it relates to the field of archaeology in Ontario. Our Chapter is but one of several in this province affiliated to the main body of the Ontario Archaeological Society, and servicing the regional needs of the archaeological community in southwestern Ontario. Our membership is just over 130 members, and we represent both professional archaeologists as well as a large and active avocational community. We service our membership through a research newsletter, **KEWA**, an Occasional Publication Series, speaker nights, social events, opportunities to work on site excavations and surveys, as well as providing our membership with a place from which to voice their opinions and concerns regarding the state of archaeology in this province. Any views we express in this submission are those of the London Chapter, and are based on our experiences.

In your letter for written submissions from individuals and groups concerned with Ontario's Heritage, you wanted discussions to revolve around identified areas of concern, outlined in your working paper submitted to heritage organizations. However, we find this difficult to do, since many of the concerns in the archaeological community stem from specific problems arising out of a substantial change in the very nature of archaeology over the past decade; a change which has moved far ahead of anything outlined for archaeology in the Heritage Act. As such, we find ourselves unable to directly address the motherhood statements in your working paper, but rather we would prefer to address those concerns and thoughts we have on specific aspects of the archaeological component of the Heritage Act, as it relates to our experiences.

Part of our inability to address the more general topics outlined in your working paper stems from the fact that under the present form of the Heritage Act, archaeology is treated as a distinct and separate part of Ontario's heritage, governed in a different manner than for the rest of those "heritage concerns or sectors" manifested in Ontario. As such, archaeology has been closely monitored and regulated through the Archaeological Unit of the Heritage Branch, Ministry of Citizenship and Culture, both in their head office, and in their five other regional offices throughout the province. Further, unlike other aspects of heritage, archaeology is identified in the Heritage Act as something that needs to be licenced by the government; regulated and defined as a controlled activity. It is perhaps through this licencing aspect of the Heritage Act that one can most clearly see the change in archaeology over the past decade, and the need for the Heritage Act to be modified to better service the archaeological community.

Initially, part of the intent behind the licencing of archaeology was to regulate site looting and uncontrolled archaeological investigation in Ontario. As archaeological sites are a non-renewable resource, there was a definite need to oversee archaeological activities in the province, in order to ensure the maintenance of a functional data base, and to preserve this valuable heritage data on Ontario's Prehistoric and Historic past. While the intent was definitely a step in the right direction, the archaeological component of the Heritage Act has served, in reality, to be little more than a statement of interest in archaeology from the provincial government, regulating only professional and conscientious archaeologists, with little ability to deal with those individuals that choose to opt out of the system, or those who prefer to simply loot sites (albeit with one notable exception from the Hamilton-Brantford area). This is certainly an obvious weakness of the Act, and there is a need for the Act to be strengthened when applied to individuals who violate it.

However, as the licencing system now stands, all individuals wishing to conduct archaeology in a legitimate fashion must follow a rather awkward and lengthy licencing process, required annually, before any archaeological activity can occur. Further, not only is the process generating problems at present, but also, in 1987, "archaeological activity" actually encompasses a wide range of endeavours. Archaeological field work can now include research-oriented projects, mostly from the academic world; consulting archaeology, which has grown in response to archaeological concerns being identified in the latest versions of both the Planning and Environmental Assessment Acts; and conservation archaeology, which can and is conducted by both professional and avocational archaeologists. It is important to note that both the type of archaeology conducted under each of these three categories and the various individuals doing this work can almost be viewed as different "subsets" of the archaeological community. The needs, concerns, qualifications and abilities for each of these categories are strikingly different, but all three groups must apply for the same type of archaeological licence. This leads to a wide range in the quality of archaeological field work and reporting, with no clear way of determining quality, as it relates to either individual qualifications or type of archaeology conducted. Such an arrangement is worrisome, since the Archaeological Unit of the Ministry of Citizenship and Culture uses the existing licencing structure as a means of regulating the archaeological community. This means that Ministry staff members are asked to appraise quality without clear directives from the Act, while still having the potential to seriously impact individual archaeologists. For example, consultant archaeologists apply for "consulting licences", which enable them to bid for work throughout some or all of this province. Getting such a licence also means an individual or institution is placed on a Ministry list of licenced consulting archaeologists, which is sent out to firms needing to hire such services. Simply put, if one isn't on the list, one cannot earn a salary. For those individuals who draw their earnings solely from consultant work, the licencing process is a powerful regulatory system which impacts directly on one's livelihood, even though the process, as it now stands, is faulty.

Perhaps what is needed, besides more clearly defining the licencing process for both applicants and those who are asked to implement it, is a licencing system which identifies different forms or levels of archaeology. For instance, one form of licence could be strictly for conservation activities. This could be available to most individuals who simply want to conduct limited field surface-survey and/or site monitoring, and the requirements and obligations for receiving such a licence would reflect the limited type of work involved. Reporting could also be straight-forward for this type of licence, providing just the basic information needed (ie. activities conducted, maps of area examined, catalogue and photos of material found). However, if someone wished to conduct more extensive work on a site, such as partial or full excavations, perhaps

requirements would include greater qualifications (such as much more experience and training), and responsibilities would include a greater degree of final reporting and site analysis. In many ways, this type of excavation archaeology for research or mitigation purposes could fall under a type of licence similar to that presently being issued (only that requirements should be more clearly defined). Finally, in regards to consultant archaeology, perhaps a third type of licence, specifically for consultant work, could be created, the qualifications and requirements of which reflect the nature of this type of assessment archaeology. This would probably exclude large-scale mitigative excavations however, which should be licenced under the second proposed licence type. By formatting archaeological licences to the different types of archaeology in Ontario, the licencing process, and the Heritage Act itself, would tend to look like a more uniform regulatory system, ensuring legal and competent archaeology is being performed and reported on, while still allowing for the diverse range of archaeological research and field work occurring in Ontario. Also, with such a change the Heritage Act will be servicing the needs of the archaeological community, and defining the role the various "sectors" of the archaeological community have in the province.

The consequences and problems of identifying archaeology as a specific and "different" section of Ontario heritage extends beyond the licencing process, however. It has also served to isolate archaeology from the rest of the heritage community, on both the local and provincial levels. This isolation also extends into the Heritage Branch of the Ministry of Citizenship and Culture, with heritage planners being unaware of the needs and value of archaeology, and archaeological unit staff being unaware of other Ministry heritage activities, some of which could or should require an archaeological component. Considering the similar interests and common goals of both the archaeological and historical heritage groups in this province, it has been extremely unfortunate that much of the last decade has been spent in isolation, and only in the last couple of years have representatives of each of these two groups begun the lengthy process of promoting themselves to each other.

A clear example of this problem as the London Chapter has experienced it is in the process of becoming involved in our local LACAC. Slightly over two years ago, members of the London Chapter began promoting archaeological conservation to our city's municipal planning department. During the course of that process, it was suggested to us, and subsequently we decided, to become "part of the system" by applying for institutional representation on the London LACAC. We felt that through this organization we could best convey our concerns to the city's planning department regarding the destruction of archaeological resources through urban development in the city of London. After all, the London LACAC is, in essence, the city's advisory council on matters of heritage. While we had anticipated a rough time trying to convey our concern to city planners, we were surprised at the degree of negative feedback and opposition we received concerning archaeology. Further, we had difficulty convincing LACAC members that we indeed had a legitimate role to play in LACAC. These individuals confided to us informally that they thought under the Heritage Act, archaeology was not part of a LACAC's heritage mandate, and therefore archaeological representation on LACAC could not be justified, or promoted to the city. Ultimately however, and with a great deal of formal support from the London LACAC, we were able to convince the city that we did indeed have reason to be represented. That even representatives of the local heritage community were difficult to convince that archaeology was a legitimate part of their own heritage concerns, underscored the isolation that presently exists between sections of the heritage community in Ontario.

Besides giving LACACs a clearer role to follow in the Heritage Act (which directs them to be concerned with all sectors of heritage in their community), the

revised Heritage Act should provide vehicles for the dissemination of information between the different sectors of the heritage community. Whether this takes the form of a newsletter from a Ministry heritage coordinator; or something more direct such as a Ministry sponsored annual heritage group executive officers meeting; or something more local such as county, district or regional local heritage group lists, is open to consideration and discussion. What is essential however is for the Heritage Act to recognize the very real need to emphasize communication and cooperation between heritage groups, and between Ministry personnel who manage the various heritage sectors. Co-ordinated heritage activities on the part of local or provincially based heritage groups can provide a greater profile within a given community of local or provincial heritage, concerns and activities, and gives the Ministry of Citizenship and Culture a greater profile in provincial heritage.

While the London Chapter has many more concerns for Ontario archaeology, such as granting and funding of archaeology; ministerial support for archaeological conservation; promotion of archaeological heritage to Native communities; and accessibility of data; these are all issues that should probably be raised by other interested parties, individuals more familiar with those areas than us. Suffice that our views expressed in this paper are those that we are familiar with on an intimate and everyday basis. We hope your committee will consider our concerns raised here when contemplating the way the Heritage Act will take shape over the next decade.

EDITOR'S NOTE

The following two research articles continue a tradition in KEWA: the thematic issue, by discussing different aspects of 17th century trade axes. Also included in this issue of KEWA is the return of an old standby for our newsletter, *Nineteenth Century Notes*; this being the first of several, we hope. Finally, these articles and note represent the talents of the Kenyon clan, Tim and Ian, two individuals who have certainly helped make KEWA such a popular newsletter across southwestern Ontario, and the province!

THE MAKING OF A SEVENTEENTH CENTURY IRON TRADE AXE

Thomas Kenyon

After recording a hundred or so iron trade axes from 17th century Ontario sites, I decided to find a blacksmith who could reproduce one of these axes and let me record the operation. By such a replicative experiment, I believed that more could be learned about this often ignored class of 17th century trade goods. Finding a suitable and cooperative blacksmith, however, proved to be a more difficult task than I had foreseen.

Introduction

I showed an authentic 17th century axe to two local "pioneer village" blacksmiths who claimed it was a simple matter to make one -- just fold a bar of heated steel over a swage and hammer out the head. Later I discovered in a book by Harold Peterson (1965) a series of drawings that showed the forging of this style of axe to be more complex than these blacksmiths believed. I finally found a blacksmith in Elora who promised to make me an axe "when he wasn't busy"; however, after a couple of years of periodically phoning or visiting him, and getting no results, I gave up.

The long search for a blacksmith ended in 1978 when Doug Cole (of Ste. Marie among the Hurons) recommended the Amber Forge, located in Niagara-on-the-Lake. This firm specialized in antique hardware, and had produced a number of iron reproductions for museums. I contacted the proprietor Mr. Ed Thalmann and showed him a 17th century trade axe from the Walker site (courtesy of W.A. Fox) as well as the illustrations in Peterson's book. Luckily, Mr. Thalmann already had an order for this style of axe and set up a date (27 April 1978) when the axe would be forged, agreeing to let me record the process. The place was to be a small blacksmith shop that was part of Amber Forge, but as the interior was dark I installed four 1000-watt photo lamps. Using two 35mm cameras, one for black and white prints, the other for colour transparencies, each step in the making of the axe was recorded. The resulting black and white prints were mounted in sequence into a book. This was then shown to the blacksmith, Arnold Lepp, and his comments on each print were recorded on a tape recorder. The text for this article was derived mostly from this recording, with the simple line drawings based on the photographs. This was the first time that Arnold had made an axe using the "fold over" technique: reproduction axes are made normally from a solid bar of mild steel with the eye punched out and the blade then being drawn out by heating and hammering.

The Making of the Axe

For the most part, standard blacksmithing tools were used in the production of the axe (Figure 1); the raw material was a rectangular bar of iron stock. The mild steel bar, 2" wide by 3/4" thick and about 24" long, was scored on one side into three sections, the first being 4" long, the second 3" and the third 4". In addition a 13" tail was left at one end to facilitate handling, during the forging of the axe in its initial stage (a, this and all subsequent references in brackets are to Figure 2). The first and third sections of the scored bar were to become the two sides of the axe blade, while the eye was to be forged from the shorter middle section.

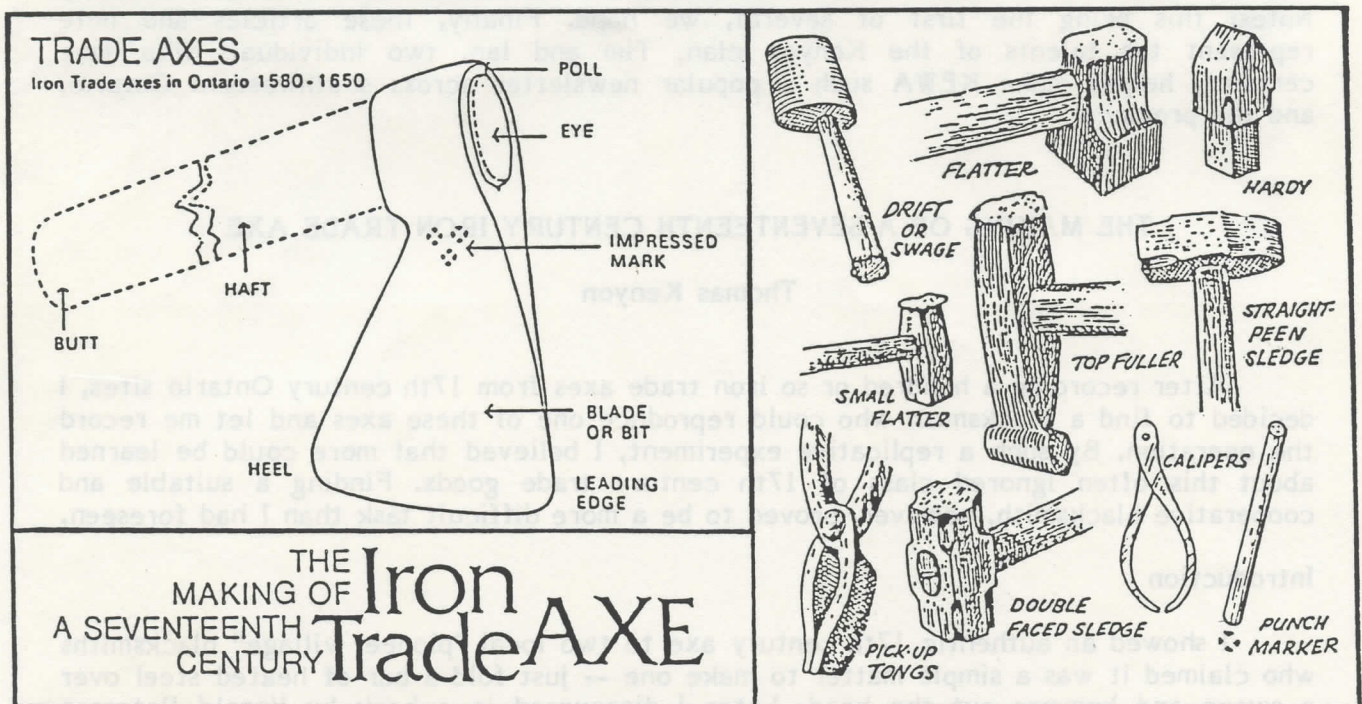


Figure 1: Axe Terminology (left) and Blacksmithing Tools (left).

The bar was then placed in the forge and the eye area heated to a dark yellow (1). As bituminous coal of good quality was difficult to obtain, coke was used as the fuel. Thinning of the eye area was started using a double faced sledge and this thinning and expanding of the eye was continued with a "top fuller" held by blacksmith Arnold Lepp, with helper Eugene Hardie doing the sledge hammering (2). This operation was repeated until the eye area consisted of a series of fuller marks (b). The eye area was reheated and a "flatter" was used by Mr. Lepp, with Mr. Hardie again sledging (3). This smoothed, further thinned, and expanded the eye and at the same time the bottom area was expanded downwards. This part formed the lip at the lower end of the eye (c). Further work with the flatter included edging, straightening and smoothing the eye section. Using the Walker axe as a guide, the thickness was checked with calipers (4). The original dimensions of the eye, $3/4"$ x $2"$ x $3"$, by now was $5/16"$ x $2 \frac{1}{4}"$ x $5 \frac{1}{2}"$.

The blade end was reheated and tapered, then the middle was reheated and cut on the third mark over a "hardy" cutting tool. The bar was turned over and cut on the other side, releasing the axe portion from the bar (d & 5). The other blade end was reheated and the end tapered: this was to allow an insert of high carbon steel. The eye part was reheated and, holding the axe with his flat-nosed tongs, the blacksmith quickly bent the eye area to form the axe (e,f & 6,7). A high carbon steel file was used as an insert and it was placed between the two blades (g & 8). The axe with its insert was reheated and the excess of steel file was trimmed. Next the edges of the blades were forged downward and tapered (h & 9).

The axe was then reheated to a welding temperature. In this "hot" state, sand was applied to prevent the sticking of scale and the burning of steel. The process of welding and shaping of the blade began, and as Arnold noted "a good weld is not only hard physically but demands much knowledge and experience of the blacksmith." In this operation the top and bottom parts of the blade were forge welded (10), the blade drawn out both in width and length (i) and flattened around the eye with a small flatter (11). The eye was reheated and a drift that was especially made for this operation was hammered into the eye (j,k & 12). This gave the eye of the axe a shape which is wider at the top than at the bottom. The axe was then turned over (l) and using a small nail anvil (13) the inside edges of the eye were joined and welded together until it formed one piece (m & 14).

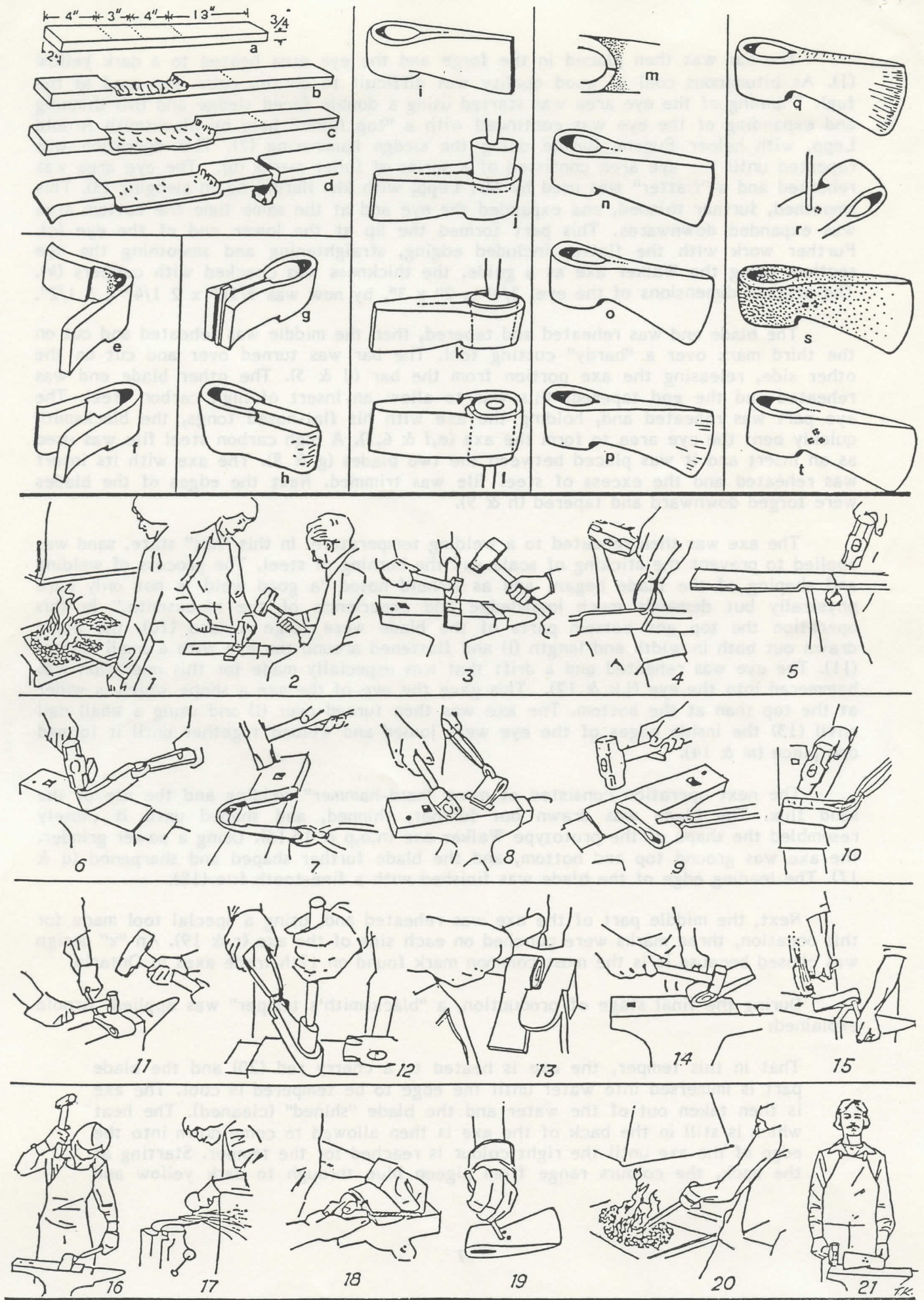
The next operation consisted of more "hard-hammer" welding and the use of the sand flux. The blade was drawn out further, thinned, and shaped until it closely resembled the shape of the prototype Walker axe (n,o,p & 15,16). Using a power grinder, the axe was ground top and bottom, and the blade further shaped and sharpened (q & 17). The leading edge of the blade was finished with a fine-tooth file (18).

Next, the middle part of the axe was reheated and, using a special tool made for this occasion, three marks were punched on each side of the axe (r & 19). An "x" design was chosen because it is the most common mark found on 17th trade axes in Ontario.

During the final stage of production, a "blacksmith's temper" was applied. Arnold explained:

That in this temper, the axe is heated to a cherry red (20) and the blade part is immersed into water until the edge to be tempered is cool. The axe is then taken out of the water and the blade "shined" (cleaned). The heat which is still in the back of the axe is then allowed to come down into the edge of the axe until the right colour is reached for the temper. Starting at the back, the colours range from pigeon blue through to dark yellow and

Figure 2: Mr. Lepp Makes an Axe.



then light yellow. Purple is the softest temper with light yellow the hardest. After the colour desired is reached, the axe is fully immersed into the water until it is completely cool.

For this particular axe a medium straw colour was chosen (s). When the axe was dry, it was given a light coating of preservative oil. The finished axe (t), recorded using my standardized data sheet (Figure 3), was somewhat larger and heavier than the prototype Walker specimen. The back of the blade was given an uncharacteristic sweeping concave shape, perhaps the result of some artistic licence by Arnold to give it more "pizazz".

After six hours of arduous blacksmithing, Arnold Lepp proudly displayed the finished axe on his 300 pound anvil (21).

References

Peterson, H.L.

1965 American Indian Tomahawks. Contributions from the Museum of the American Indian, Heye Foundation, Vol. 19. New York.

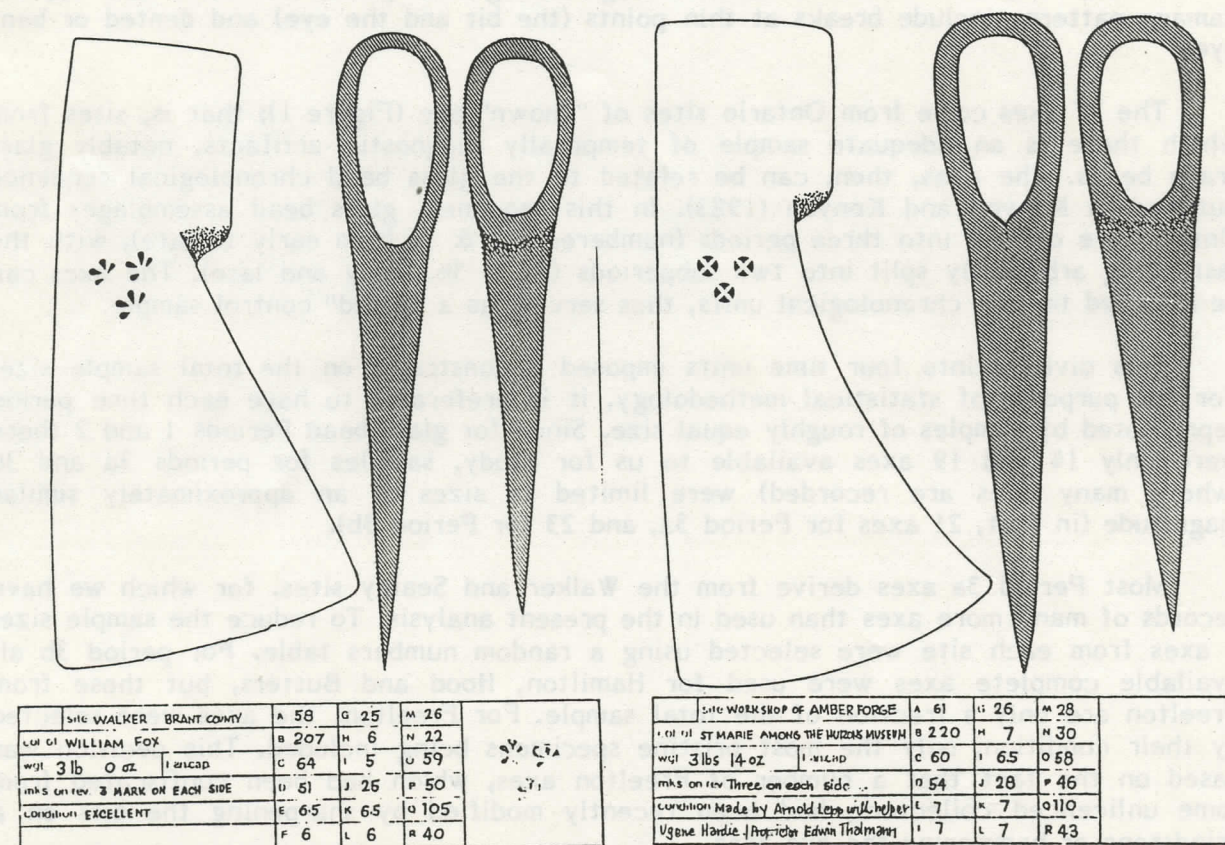


Figure 3: The Prototype Walker Axe (left) and the Axe Made by Arnold Lepp (right) These drawings are examples of the standardized data sheets. Note that the drawings, originally made at actual size, are reduced here; measurements (A-R) are given in mm.

THE IRON TRADE AXE IN ONTARIO, ca. A.D. 1580-1650: EXPLORATORY DATA ANALYSIS

Ian Kenyon and Thomas Kenyon

For some years we have been conducting a study of trade axes found on Early Historic sites in Ontario. In what follows, a subset of these axes will be examined using certain statistical methods that have proven useful in the analysis of glass trade bead assemblages from Ontario sites (e.g. Kenyon and Fitzgerald 1986). This analysis, however, is intended to be exploratory rather than definitive, attempting to identify some broad trends or patterns within the ca. A.D. 1580-1650 era. The analysis will be based on a "control" sample of axes, derived from contexts whose approximate dates can be established through other lines of evidence.

The Axe Sample

While we have measured 213 iron trade axes from Ontario, only about 1/3 (77) of the axes are incorporated into the following analysis. A number of considerations prompted this particular selection of axes. One was that the axes be relatively complete with shapes undistorted by heavy use, thus allowing for reliable measurement. Made of "soft" iron, trade axes often sustained damage during their period of Native use. Typical damage patterns include breaks at thin points (the bit and the eye) and dented or bent eyes.

The 77 axes come from Ontario sites of "known" age (Figure 1); that is, sites from which there is an adequate sample of temporally diagnostic artifacts, notably glass trade beads. The axes, then, can be related to the glass bead chronological sequence outlined in Kenyon and Kenyon (1983). In this sequence, glass bead assemblages from Ontario are divided into three periods (numbered 1, 2 & 3, from early to late), with the last being arbitrarily split into two subperiods (3a & 3b, early and late). The axes can be assigned to four chronological units, thus serving as a "dated" control sample.

This division into four time units imposed a constraint on the total sample size. For the purposes of statistical methodology, it is preferable to have each time period represented by samples of roughly equal size. Since for glass bead Periods 1 and 2 there were only 14 and 19 axes available to us for study, samples for periods 3a and 3b (where many axes are recorded) were limited to sizes of an approximately similar magnitude (in fact, 21 axes for Period 3a, and 23 for Period 3b).

Most Period 3a axes derive from the Walker and Sealey sites, for which we have records of many more axes than used in the present analysis. To reduce the sample size, 9 axes from each site were selected using a random numbers table. For period 3b all available complete axes were used for Hamilton, Hood and Butters, but those from Freulton are only a fraction of the total sample. For Freulton, the axes were selected by their condition, only the most pristine specimens being included. This decision was based on the fact that a number of Freulton axes, which had been confiscated from some unlicensed collectors, had been recently modified by sharpening the bits on a grindstone or hammering the eye area.

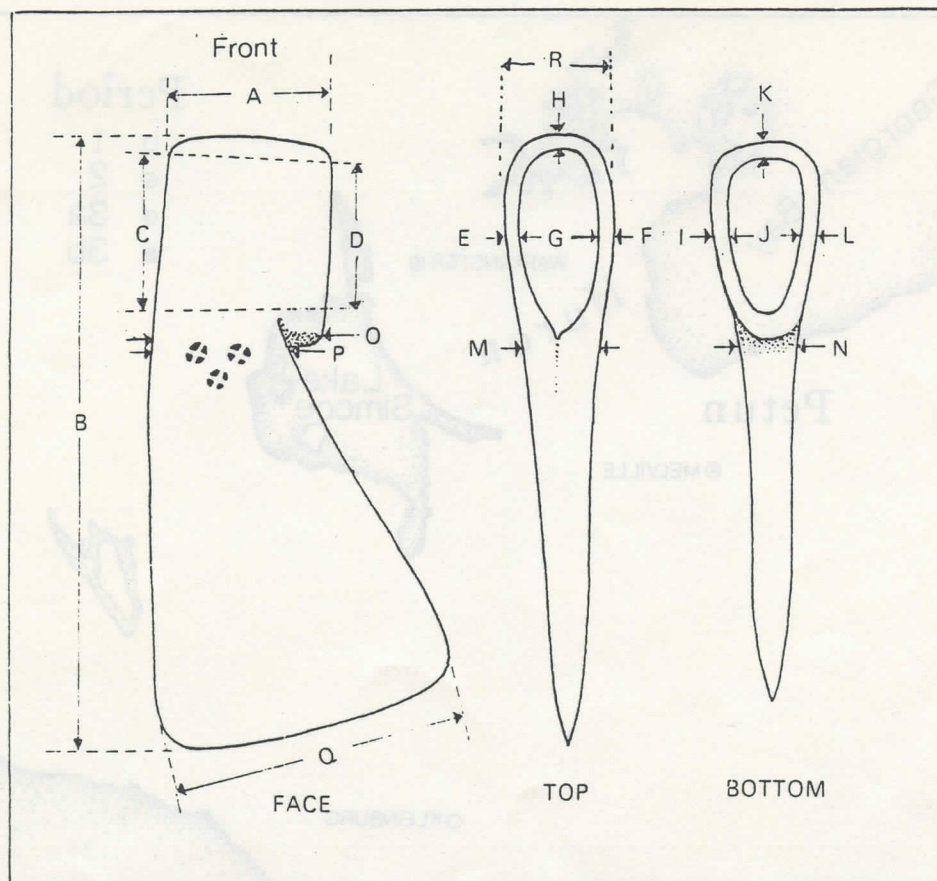


Figure 2: Axe Measurements (taken in mm)

For each axe, 18 linear measurements (in mm) were taken (Figure 2). In this present exploratory analysis, only 8 measurements were employed (Table 1). These measurements were considered enough to minimally represent the three-dimensional size and shape variation of the axes, the excluded measurements being largely redundant. Two measurements are composites: IJL is the total of the three lettered measurements (Figure 2), which when summed give the total width of the back of the axe eye (since I and L are the thicknesses of the eye loop and J is the inner width). Similarly the DK measurement represents the height of the eye.

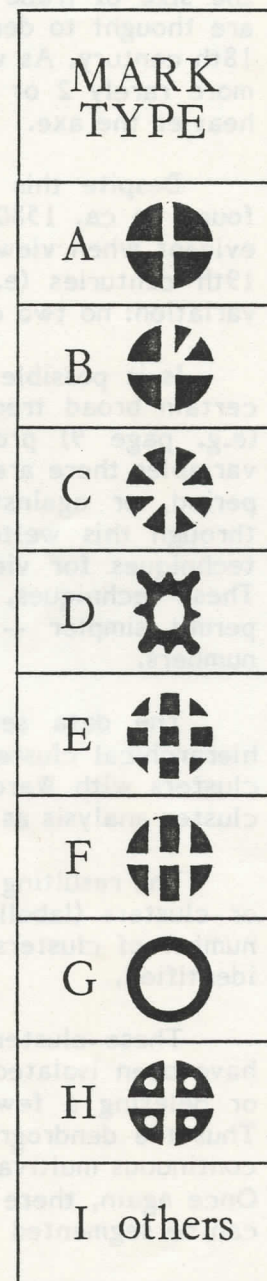
Measurements from the back of the eye were favoured over those from the front, since one typical damage pattern is the slight denting of the front area of the axe poll (perhaps from either use as an improvised hammer or as a biproduct of handle replacement). This denting or flattening of the eye distorts the measurements, increasing eye width (IJL) and decreasing eye height (DK).

There are certain errors inherent in the measurements. Most important is the fact that these axes vary in their state of preservation. While some have almost no oxidization, others are notably corroded. Some specimens have been mechanically or electrolytically cleaned while others are still rusted. Oxidization, which "swells" the axe, may have the effect of increasing linear measurements, while cleaning may

Table 1: Axe Data Set by Site and Period. Note that "mark no." denotes the number of marks on the side of the axe, while "mark type" refers to Figure 3. A dash in the mark columns indicates that no mark is visible (usually obliterated through corrosion)

Axe No.	Site	A	B	IJL	KD	N	O	P	Q	Mark No.	Mark Type	Group
PERIOD 1												
103	Kleinburg	70	230	36	62	25	68	54	119	-	-	A
104	Kleinburg	65	218	32.5	56.5	24	63	55	119	3	a	A
105	Kleinburg	66	232	34.5	61.5	28	68	60	128	3	c	A
106	Kleinburg	63	208	32	60	24	62	48	122	-	-	A
107	Kleinburg	62	223	33.5	58	25	60	54	115	-	-	A
108	Kleinburg	67	212	35	58	28	64	53	115	-	-	A
109	Kleinburg	70	216	35	61	30	70	60	124	-	-	A
110	Kleinburg	69	222	35	63	29	71	62	116	1	i	A
111	Kleinburg	64	210	32	58	25	59	51	114	7	?	A
112	Kleinburg	63	206	32	54	27	65	51	107	1	i	A
195	Tregunno	71	186	33	55	23	70	61	106	-	-	A
196	Tregunno	63	206	36	60	24	68	61	114	-	-	A
197	Tregunno	67	211	37	57	31	64	58	109	-	-	A
198	Tregunno	66	204	36	60	23	66	62	90	-	-	A
PERIOD 2												
12	Warminster	57	207	31.5	53	21	55	43	90	1	a	B
13	Warminster	54	208	31.5	49	18	54	45	104	-	-	B
14	Warminster	58.5	208	35	56	21	53	41	100	1	a	B
15	Warminster	58	200	36	61	25	56	50	112	3	a	C
16	Warminster	55	202	33	55	21	57	45	107	1	a	B
18	Warminster	54	190	33	54	22	54	47	107	1	a	B
19	Warminster	57	210	34	50	19	54	48	103	1	a	B
20	Warminster	52	206	34.5	53	21	53	44	102	1	b	B
21	Warminster	50	200	32.5	58	22	47	40	104	2?	c	B
22	Warminster	58	205	33	54	22	57	48	105	1	a	B
94	Shaver Oss	53	211	32	55	22	50	41	107	1	c	B
166	Fradenburg	59	198	33.5	55	21	56	43	101	4	e	B
179	Melville	56	194	31.5	52	25	57	46	97	1	a	B
180	Melville	57	201	32.5	57	23	53	42	109	3	e	B
181	Melville	61	192	36	62	27	62	52	103	3	a	D
182	Melville	58	191	34.5	55	26	57	47	107	3	a	C
193	Brown	56	198	32	58.5	23	55	47	113	3	b	B
194	Brown	54	200	34	57	21	59	44	107	1	?	B
199	Providence Bay	58	198	34	58.5	24.5	55	42	102	1	a	B
PERIOD 3a												
11	Sealey	60	210	36	56	20	54	45	95	1	a	B
31	Sealey	55.5	186	35	55	25	57	46	97	2	a	C
43	Sealey	62	196	35	56	25	58	44	112	3	a	C
45	Sealey	59	215	33	59	24	59	47	108	3	a	C
47	Sealey	53	172	33.5	51	22	50	38	85	1	e	C
48	Sealey	60	201	35	58.5	23	57	43.5	111	3	a	C
50	Sealey	55	200	36	56	24	54	47	118	-	-	C
51	Sealey	58	195	36	54.5	24	55	43	99	-	-	C
54	Sealey	63	211	37	60	24	59	47	108	-	-	C
5	Walker	55	168	36	55	25	51	42	89	-	-	E
27	Walker	59	202	36	59	24	57	45	107	3	a	C
34	Walker	58	206	37	61	25	55	46	114	3	f	C
35	Walker	54	191	36	54.5	25	53	46	105	3	a	C
40	Walker	56	201	34	61	22	54	42	103	3	a	B
63	Walker	65	207	36	59	21	60	49	113	3	a	C
64	Walker	61	214	34	59	24	59	49	104	3	a	C
70	Walker	59	208	36	57.5	24	58	45	94	-	-	C
147	Walker	57	212	35	57	25	60	44	108	3	a	C
83	Dwyer	59	200	35.5	53	24	59	50	105	3?	a	C
84	Dwyer	37	167	31	50	25	36	31	82	1	a	E
85	Dwyer	55	186	35	53	22	53	47	93	1	a	B
PERIOD 3b												
1	Hood	48	177	38	49.5	18	45.5	41	93	2	a	E
2	Hood	55	192	36	56	27	57	47	95	3	a	C
119	Hood	59	185	38	59	26	59	51	93	1	a	D
6	Hamilton	60	210	38	59	18	57	48	95	-	-	D
7	Hamilton	58	173	33	53	20	59	52	95	2?	a	B
8	Hamilton	45	160	34.5	49	19	45	39	79	1	c	E
113	Hamilton	55	178	34	54	21	53	41	89	1	a	E
143	Hamilton	62	191	34	61	23	61	46	84	3	a	D
151	David Butters	53	185	38	59	28	49	45	85	-	-	D
200	Freelton	56	202	40	61	28	57	51	100	3	f	D
201	Freelton	55	194	39	61	22	55	46	91	3	b	D
202	Freelton	58	189	38	55	27	56	52	94	3	a	C
203	Freelton	59	206	35	57	25	55	46	104	3	a	C
204	Freelton	61	193	38	61	25	60	51	96	3	a	D
205	Freelton	59	204	40	62	27	58	48	97	3	a	D
206	Freelton	59	201	39	59	27	59	52	100	3	a	D
207	Freelton	58	192	35	56	27	57	48	97	3	a	C
208	Freelton	55	192	37	55	25	54	47	99	3	c	C
209	Freelton	58	191	36	52	23	53	46	92	3	c	B
210	Freelton	63	195	35	60	26	63	53	94	3	c	D
211	Freelton	57	203	37	58	27	57	49	99	3	a	D
212	Freelton	59	204	36	60	28	59	51	99	3	a	D
213	Freelton	46	155	33	51	24	42	36	77	1	c	E

Figure 3: Axe Mark Type.



decrease these measurements. Unfortunately we do not have a suitable set of "before" and "after" measurements to check the precise effect of cleaning on axe dimensions. As well, some axes have bits that were resharpened by grinding, thus reducing the B and Q measures. A few axes (especially those from the important Warminster sample) had damaged bits, so that it was necessary to estimate by eye certain measurements (B & Q). Lastly, some axes may have slightly distorted eye measurements (IJL, DK), although we have attempted to eliminate such specimens from the analysis.

Analysis

It is relatively well known among archaeologists, even if not well published, that the size of trade axes varies according to time and to mark number. In general, axes are thought to decrease in size through time, culminating in the light "belt" axe of the 18th century. As well, the number of marks on the side of the axe (usually 1 or 3, much more rarely 2 or 4) is roughly correlated to the size of an axe: the more marks, the heavier the axe.

Despite this variation, apparent in the 77 axe sample examined here, trade axes found on ca. 1580-1650 sites in Ontario are, in essence, the same type. This becomes evident when viewed in contrast with the numerous axe varieties known in the 18th and 19th centuries (e.g. Peterson 1965). Yet as handmade products, there is significant variation: no two of the 77 axes are precisely identical in size and shape.

Is it possible to discern subtypes or varieties within the 77 axe collection? While certain broad trends are apparent, "eyeballing" the axe drawings on the data sheets (e.g. page 9) produces only innumerable "possible" subtypes. With 77 axes and 8 variables there are 616 separate measurements to "play with". Plotting variables by time period, or against one other, yields "interesting" but inconclusive results. To hew through this welter of axe measurements, it seemed necessary to use more complex techniques for viewing the data, such as cluster analysis and multivariate statistics. These techniques, however, are complex only in a computational sense, since they may permit simpler -- and more interpretable patterns -- to emerge from the mass of numbers.

The data set, consisting of the 8 dimensions of 77 axes, was run through a hierarchical cluster analysis routine, using the Euclidean distance measure and forming clusters with Ward's criterion (the computational details are provided in such books on cluster analysis as Anderberg 1973).

The resulting dendrogram (Figure 4) can be interpreted as having 5 principal groups or clusters (labelled A through E). As with all such dendrograms, fewer or greater number of clusters can be extracted by merely changing the level at which clusters are identified.

These clusters should not be treated as types in the sense that "natural" groups have been isolated. From preliminary computer runs it became apparent that by adding or deleting a few axes significantly different clustering patterns could be obtained. Thus the dendrogram of Figure 4 should be viewed as a "dissection" of a more-or-less continuous multivariate reality, rather than as a discovery of discrete or inherent types. Once again, there is only one type of axe represented, but its size and shape variation can be segmented into archaeologically interpretable groups, as shown below.

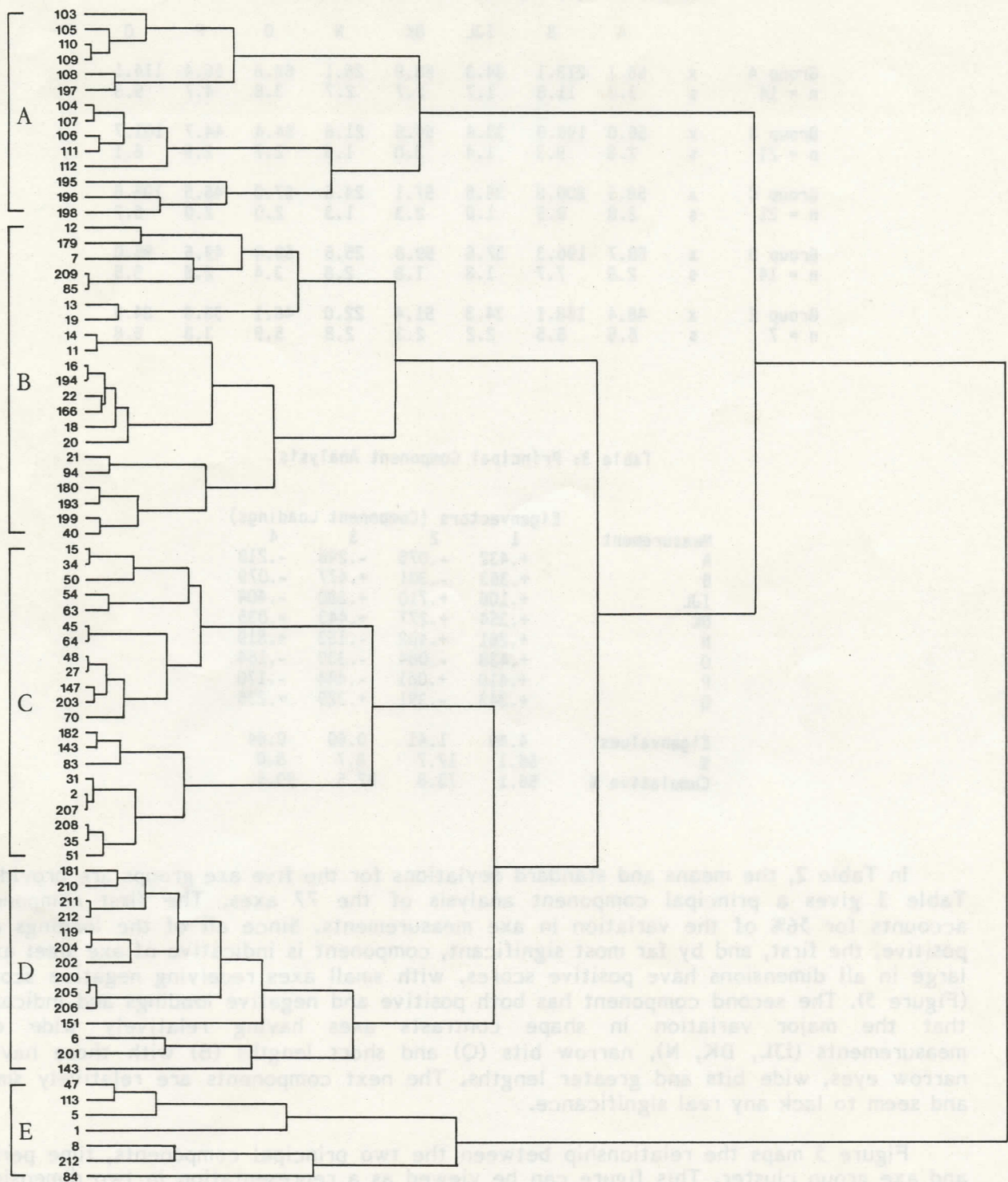


Figure 4: Hierarchical Cluster Analysis of Iron Axes. Letters denote the 5 axe groupings, as discussed in the text. Axe numbers can be cross-referenced with Table 1.

Table 2: Means (x), Standard Deviations (s) and Sample Sizes (n) for the Five Axe Clusters.

		A	B	IJL	DK	N	O	P	Q
Group A n = 14	x	66.1	213.1	34.3	58.9	26.1	65.6	56.4	114.1
	s	3.0	11.8	1.7	2.7	2.7	3.8	4.7	9.3
Group B n = 21	x	56.0	199.9	33.4	54.8	21.6	54.4	44.7	101.7
	s	2.5	9.3	1.4	3.0	1.6	2.7	2.9	6.1
Group C n = 21	x	58.5	200.8	35.5	57.1	24.6	57.0	46.5	105.6
	s	2.8	8.5	1.0	2.3	1.3	2.0	2.0	6.7
Group D n = 14	x	58.7	196.3	37.6	59.8	25.6	58.0	49.6	95.0
	s	2.8	7.7	1.8	1.8	2.8	3.4	2.6	5.5
Group E n = 7	x	48.4	168.1	34.3	51.4	22.0	46.1	38.3	84.9
	s	6.5	8.5	2.2	2.3	2.8	5.9	3.8	5.8

Table 3: Principal Component Analysis

Measurement	Eigenvectors (Component Loadings)			
	1	2	3	4
A	+.432	-.075	-.245	-.218
B	+.363	-.301	+.477	-.079
IJL	+.106	+.710	+.280	-.404
DK	+.354	+.277	+.443	+.035
N	+.261	+.402	-.153	+.819
O	+.438	-.064	-.330	-.164
P	+.410	+.061	-.444	-.170
Q	+.343	-.391	+.329	+.236
Eigenvalues	4.49	1.41	0.69	0.64
%	56.1	17.7	8.7	8.0
Cumulative %	56.1	73.8	82.5	90.5

In Table 2, the means and standard deviations for the five axe groups are provided. Table 3 gives a principal component analysis of the 77 axes. The first component accounts for 56% of the variation in axe measurements. Since all of the loadings are positive, the first, and by far most significant, component is indicative of axe size: axes large in all dimensions have positive scores, with small axes receiving negative scores (Figure 5). The second component has both positive and negative loadings and indicates that the major variation in shape contrasts axes having relatively wide eye measurements (IJL, DK, N), narrow bits (Q) and short lengths (B) with those having narrow eyes, wide bits and greater lengths. The next components are relatively small and seem to lack any real significance.

Figure 5 maps the relationship between the two principal components, time period and axe group cluster. This figure can be viewed as a representation in two dimensions (the first two components) of the 8 dimensions (measurements) of the axe sample, capturing 74% of the variation (the sum of the first two eigenvalue percentages). Inspection of the figure reveals a relationship between axe group type and site period.

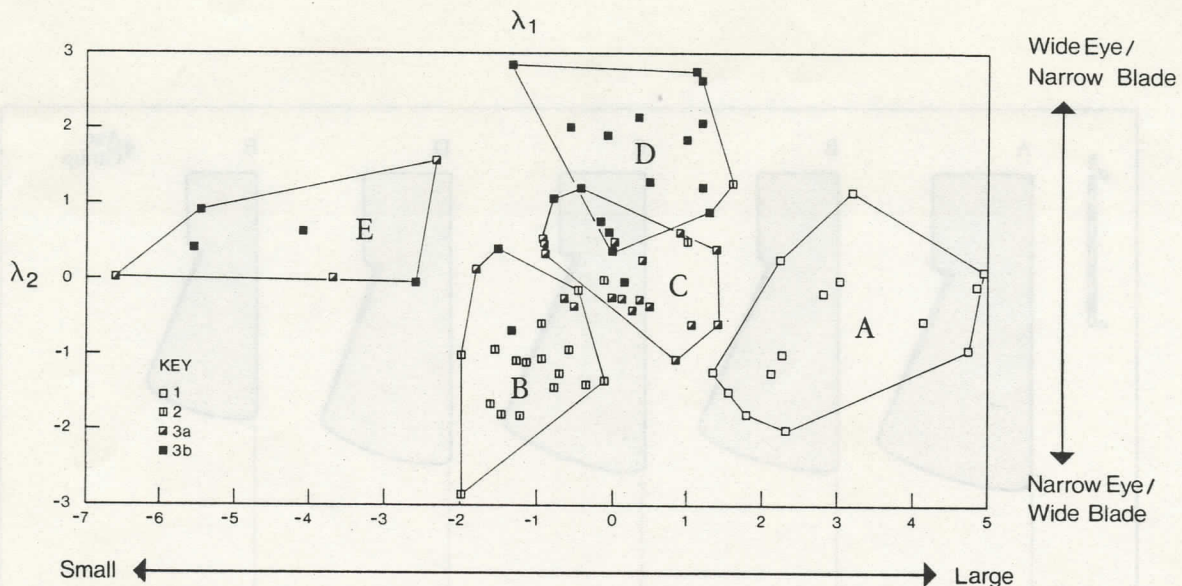


Figure 5: Graph showing axes plotted against the first two principal components. The encircling lines (convex hulls) show the range or scatter of axes belonging to the five type clusters.

This time and axe group relationship is more explicitly given in Figure 6. In Figure 6 (upper), diagrammatic outline drawings are provided for the five axe group clusters, based on the mean statistics of Table 2. When these five types are plotted against the four time periods (Figure 6: lower), a "good" seriation is apparent.

Group A. The Group A axes are notable for their relatively large size, particularly in the A, B, O, P and Q dimensions. All Period 1 axes are identified as Group A, and no Group A axes are found on later sites. Chronologically, this is the most discrete axe group.

Group B. Group B axes are strongly associated with Period 2 sites, particularly Warminster where 9 of 10 axes were assigned to this group. Group B axes tend to be rather narrow (low IJL and N measurements). Typically these axes have only a single stamp.

Group C. Group C axes are slightly larger than Group B axes in almost all dimensions. These axes are most closely associated with Period 3a sites (7 out of 9 specimens at both Sealey and Walker). Unlike the Group B axes, these usually have three marks.

Group D. Group D axes are similar in size to Group C axes, but measure slightly less in overall length (dimension B) and bit width (Q). Like Group C, these axes typically have three stamps. Group D axes tend to be found on Period 3b sites.

Group E. Compared to the previous four groups, these are very small axes, found both in periods 3a and 3b. In contrast to Group C and D, these tend to have only a single mark. Thus they would appear to be the small size-grade of axe traded during Period 3 times.

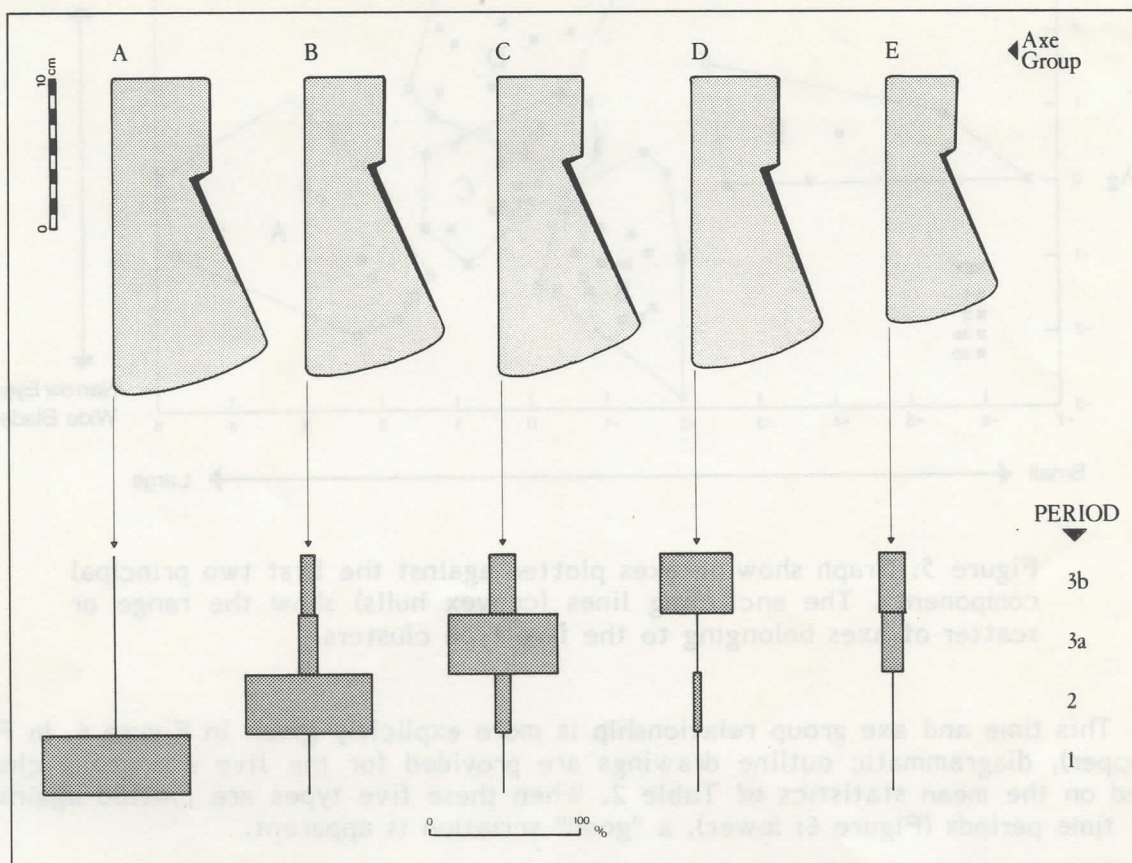


Figure 6: Modal axe shapes and sizes for the five clusters (above) and percentage seriation by glass bead period (below).

The preceding analysis of axes from dated sites indicates that iron trade axes changed during the ca. A.D. 1580-1650 period. Hence, it might be possible to take axes from unknown contexts and establish dates for these specimens by comparing them to the "control" sample. This exercise might be particularly revealing for isolated axe finds outside of areas associated with historic village settlements. For example, in an earlier issue of KEWA, Ferris (1986) reports an isolated iron axe find near Bothwell (Under-the-Christmas-Tree site), located 150 km west of the 17th century Neutral village cluster at the head of Lake Ontario. Isolated finds such as this may represent artifact losses by travelling hunting or fishing groups, or perhaps even war parties. Based on visual comparisons with our 'axe data sheets, Ferris suggested that the Bothwell specimen dated between 1630 and 1650.

A more rigorous chronological assignment can be made using the 77 axe control sample. Tatsuoka (1971:218-225) has presented a method of statistical assignment using the "minimum chi-square rule". This method compares the measurement of an "unknown" specimen to the group means of specimens from known contexts or types (in this case

the five axe clusters). For the unknown specimen the statistical "distance" (chi-square) from each group is made in turn, the unknown specimen being assigned to the group to which it is most similar (the lowest distance value). This method, however, requires access to a computer since it uses matrix algebra to determine distance in multivariate space. For the Bothwell specimen these distance measures are as follows:

<u>Cluster</u>	<u>Distance</u>
Group A	36.4
Group B	15.9
Group C	12.4
Group D	3.0
Group E	26.2

The Bothwell axe is clearly similar to Group D axes, most of which are found on Period 3b sites. Period 3b dates to the 1630s or 1640s, thus confirming Ferris' original assessment.

If additional such isolated finds were examined using this method, then it might be possible to establish patterns of exploitation through time in zones beyond the frontiers of 17th century Ontario Iroquois village clusters.

Conclusions

This study has identified certain changes in axe dimensions thorough time, by use of cluster and principal component analysis. The Period 1 axes (Group A) are conspicuously large, representing a fairly discrete cluster. In Period 2 a smaller and rather slender axe (Group B) with one stamp becomes the dominant type. During Period 3 there are large three-stamp axes (Groups C & D) in use along with smaller one-stamp axes (Group E). The three-stamp axes change during Period 3, with length and bit measurements being reduced through time.

We should reiterate that the axe groups identified by this cluster analysis should not be considered formal archaeological types, but rather as useful, although somewhat arbitrary, segmentation of a nearly continuous range of variation.

Lastly, the use of the control sample for the assignment of specimens of unknown chronological context has the potential of identifying changing Native exploitation patterns outside of village heartlands.

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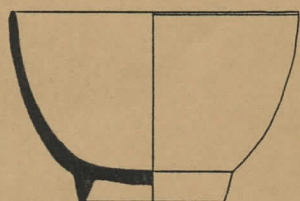
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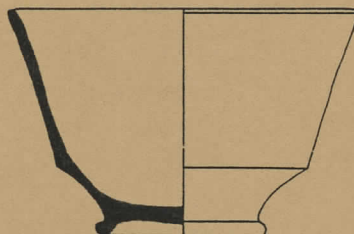
NINETEENTH CENTURY NOTES

Ceramic Cups

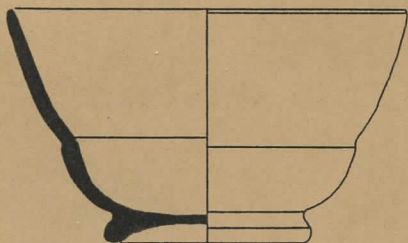
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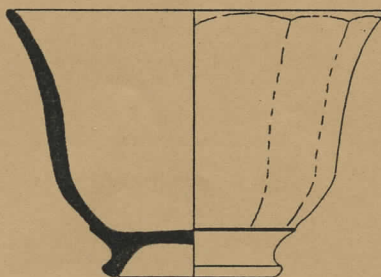
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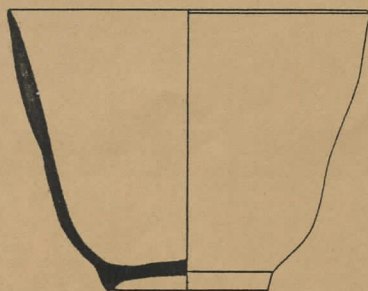
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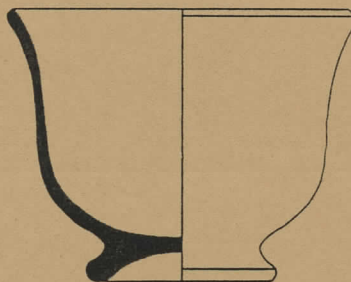
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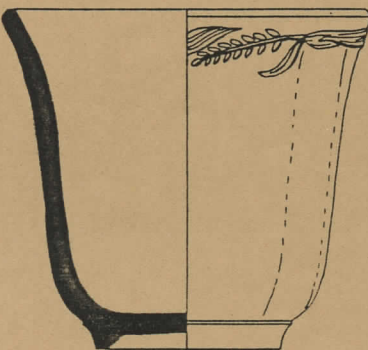
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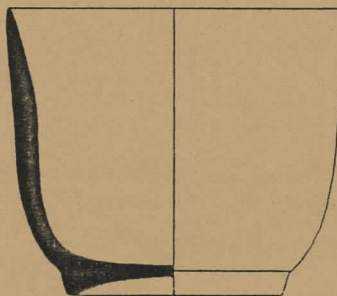
e



f



g



h

Through the 19th C. white earthenware cups displayed great variation in their form. A few of the more popular shapes are discussed and illustrated here. Bear in mind that throughout most of the 19th C., cups were often sold in both handled and unhandled forms. As well, each style of cup would often be sold in a number of different sizes.

In the first two decades of the century, the most common form was derived from the prototypical Chinese teacup. This cup (a) had a hemispherical body with high wedge-shaped footings, typically made in creamware or pearlware.

In the mid-1810s, a new form was introduced which had a carinated or inverted cone shape (b). At the Spode factory this was called the "London" shape, introduced c1813. Rapidly supplanting the earlier Chinese-like cup by 1820, the London shape remained the most popular cup until the 1840s. Some variants had flaring lips, unlike the straight-sided form shown here.

A number of new cup shapes were popularized in the 1840s. One of these had a bell-shaped form (c). Another mid-1840s type, popular for white granite and printed wares, had fluted or faceted sides (d). It was known as "French Fluted".

By the 1850s the bell-shaped cup was modified so that it had a less pronounced waist (e). This form was particularly popular for low-priced sponge and painted wares. Another mid-century form resembled the London shape, only with no sharply defined carination (f).

The 1860s through to the 1880s saw the dominance of white granite ware. Each of the innumerable patterns had a distinctive cup form. The most popular white granite pattern was "wheat" or "ceres" (introduced 1859), which had a fluted cup featuring wheat mouldings about the rim (g).

By the end of the century, white granite was loosing ground to semi-porcelain wares, whose cup forms were often patterned after the elaborate shapes that characterized true porcelain. A typical late 19th C. white granite cup form had a squat, cylindrical shape (h).

Scale: 1/2 size